SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

(K21PG)

PROJECT TITLE:

Ai in Astronomy

Course Name: ARTIFICIAL INTELLIGENCE

Course Code: INT 404

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Introduction

Astronomy is the study of everything in the universe beyond the Earth's atmosphere. This includes objects that we can see with the naked eye, such as the sun, moon, planets, and stars. It also includes objects that we can only see with telescopes or the other instruments, such as distant galaxies and small particles.

One of the benefits of artificial intelligence in astronomy is the ability to quickly and accurately analyse and process large amount of data. Astronomy generates large amount of data from telescopes, satellites, and other instruments and it can be overwhelming for humans to analyse all this information.

Machine Learning helps to distinguish the signs of planets from other fluctuations in the light of these stars and to identify exoplanets that would otherwise be difficult to spot. Look for transient events such as supernovae and their glowing counterparts to detect gravitational waves.

DIFFERENT APPLICATIONS OF AI IN ASTRONOMY

CLASSIFICATION OF GALAXIES: Ai can be used to classify di fferent types of galaxies based on visual characteristics, such as elliptical or spiral galaxies. This could help astronomers better understand the properties of galaxies and how they evolve over time.

DATA ANALYSIS:AI can be used to analyze large volumes of astronomical data, such as from telescopes or satellites. This can help astronomers identify patterns and relationships in th e data that are difficult to detect by hand.

OBJECT DETECTION: AI can be used to detect and identify o bjects such as stars, planets, and asteroids in astronomical im ages. this can help astronomers study the properties and beha viour of these objects.

TELESCOPE CONTROL: Telescope pointing and tracking can be optimized with artificial intelligence algorithms to improve the efficiency and accuracy of astronomical observations.

GRAVITATIONAL WAVE DETECTION: AI is used to analyze data from gravitational wave detectors such as the laserinterferometer gravitational wave observatory (ligo) to identify gravitational wave signals and distinguish them from background noise.

STELLAR CLASSIFICATION: AI can classify stars based on the ir spectra, helping astronomers understand their evolution and behaviour.

- **Future Scope**
- **Automatic telescope control**: Artificial intelligence algorithms can be used to optimize telescope control to make observations more efficient and accurate.
- **Real-Time Data Analysis**: Use artificial intelligence algorithms to analyse real-time data to more quickly identify objects and events of interest in the sky.
- **Custom Observing Plans**: AI algorithms can generate personalized observing plans for astronomers based on their specific research interests and priorities.
- **Predictive Modeling**: AI algorithms can be used to create predictive models of astronomical phenomena, allowing astronomers to predict events before they happen.
- **Machine Learning Assisted Data Analysis**: Artificial intelligence algorithms can be used to aid in data analysis, helping astronomers identify patterns and trends in large data sets.
- **Software Requirements :**
- **PyCharm** :- PyCharm provides a range of features and tools that can be useful for improving the accuracy and speed of data analysis through machine learning algorithms.

- **Database Support** : PyCharm has built-in support for a variety of databases, including MySQL, PostgreSQL, SQL Server. You can connect a database directly from PyCharm and run SQL queries on it.

Conclusion

In conclusion, AI is transforming the Astronomy field, particularly in personalized. While there are challenges to implementing AI in Astronomy systems, but its help to the benefits to people to know about star and planet and their data which change. However, it is important to consider the potential impact of AI on the Astronomical field to observed the object behaviour.

References

- ***AstroML: Machine Learning and Data Mining for Astronomy — astroML 1.0 documentation***
- ***https://nssdc.gsfc.nasa.gov/planetary/factsheet/***

Code:

```
#File 1
import sqlite3
import tkinter as tk
from tkinter import ttk
from tkinter import *
from tkinter.font import Font
# Define the GUI
```

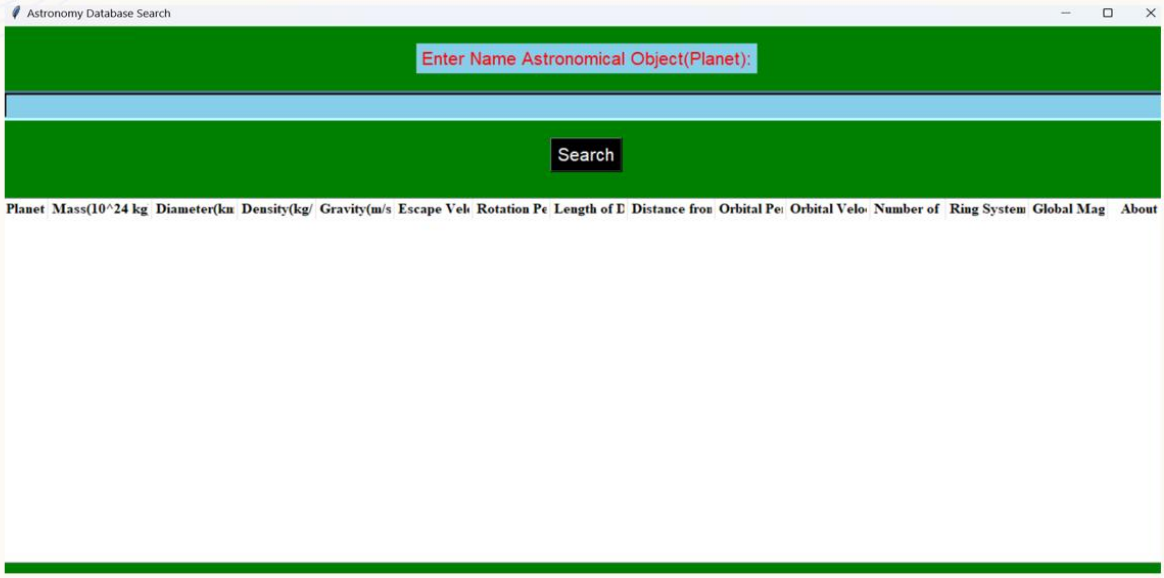
```
root = tk.Tk()
root.title("Astronomy Database Search")
root.geometry("1400x700")
root. configure(bg="green")
 # Define the database connection
conn = sqlite3.connect("astronomy.db")
c = conn.cursor()
 # Define the function to search the database
 def search_database():
    # Get the search query from the search box
    search_query = search_box.get()
    # Execute the SQL query to search for the data
    c.execute("SELECT * FROM planets WHERE name LIKE ?", ('%' +
search_query + '%',))
    results = c.fetchall()
    # Clear the previous results from the results treeview
    for i in result_treeview.get_children():
        result_treeview.delete(i)
# Display the new results in the results treeview
    for result in results:
        result_treeview.insert('', tk.END, values=result)
# Define the search box
search_label = tk.Label(root, text="Enter Name Astronomical
Object(Planet):", borderwidth=5, foreground="Red", bg="skyblue",
font="Bold")
search_label.pack(pady=20)
search_box = tk.Entry(root, width=130, borderwidth=5,
foreground="Red", bg="Skyblue", font="Strong")
search_box.pack()
# Define the search button
search_button = tk.Button(root, text="Search", bg="Black",
foreground="White", font="Strong", command=search_database)
```

```
search_button.pack(pady=20)
 # Define the results treeview
result_treeview = ttk.Treeview(root, height=20,  columns=(
   "Planet", "Mass (10^24 kg)", "Diameter (km)", "Density (kg/m^3)",
"Gravity (m/s^2)",
   "Escape Velocity (km/s)", "Rotation Period (hours)", "Length of Day
(hours)",
   "Distance from Sun (10^6 km)", "Orbital Period (days)", "Orbital
Velocity (km/s)",
   "Number of Moons", "Ring System?", "Global Magnetic Field?",
"About"), show='headings', style='Treeview', selectmode='browse’)
# root.tk_setPalette(background='Red')
header_font = Font(family='Times New Roman', size=12,
weight='bold')
style = ttk.Style(root)
style.configure('Treeview.Heading', font=header_font)
result_treeview.heading("Planet", text="Planet")
result_treeview.heading("Mass (10^24 kg)", text="Mass(10^24 kg)")
result_treeview.heading("Diameter (km)", text="Diameter(km)")
result_treeview.heading("Density (kg/m^3)", text="Density(kg/m^3)")
result_treeview.heading("Gravity (m/s^2)", text="Gravity(m/s^2)")
result_treeview.heading("Escape Velocity (km/s)", text="Escape
Velocity(km/s)")
result_treeview.heading("Rotation Period (hours)", text="Rotation
Period(hours)")
result_treeview.heading("Length of Day (hours)", text="Length of
Day(hours)")
result_treeview.heading("Distance from Sun (10^6 km)",
text="Distance from Sun(10^6 km)")
result_treeview.heading("Orbital Period (days)", text="Orbital
Period(days)")
```

```
result_treeview.heading("Orbital Velocity (km/s)", text="Orbital
Velocity(km/s)")
result_treeview.heading("Number of Moons", text="Number of
Moons")
result_treeview.heading("Ring System?", text="Ring System?")
result_treeview.heading("Global Magnetic Field?", text="Global
Magnetic Field?")
result_treeview.heading("About", text="About")
result_treeview.pack(pady=10)
# Start the GUI main loop
root.mainloop()

# Close the database connection when the GUI is closed
conn.close()
```


FIGURE 1




```
import sqlite3
```

```
import tkinter as tk
from sqlparse.filters import output
# Create the database and table
conn = sqlite3.connect('astronomy.db')
c = conn.cursor()
c.execute('''CREATE TABLE IF NOT EXISTS planets
        (name text Primary Key, mass real, diameter real, density real,
        gravity real, escape_velocity real, rotation_period real,
        length_of_day real, distance_from_sun real, orbital_period
real,
        orbital_velocity real, moons integer, ring_system text,
        global_magnetic_field text, about Text)''')
# Insert sample data into the table
data1 = [('Mercury', 0.330, 4879, 5427, 3.7, 4.3, 1407.6, 4222.6, 57.9,
88.0, 47.4, 0, 'No', 'Yes', 'Mercury is the smallest planet in the Solar
System\nand the closest planet to the Sun. It has a rocky,\ncratered
surface, with a heavily cratered highland\nregion and smoother,
younger plains. It has no moons,\nno atmosphere to speak of, and no
magnetic field. \nDue to its proximity to the Sun, its surface
temperature\ncan reach up to 800 degrees Fahrenheit during the
day\nand drop to -290 degrees Fahrenheit at night. It takes\nMercury
88 Earth days to orbit the Sun and rotates on\nits axis once every 59
Earth days.\n'),
('Venus', 4.87, 12104, 5243, 8.9, 10.4, -5832.5, 2802.0, 108.2, 224.7,
35.0, 0, 'No', 'No', 'Venus is the second planet from the Sun and is
similar in\nsize and structure to Earth. It is sometimes referred to
as\nthe Earth sister planet. Venus has a thick atmosphere
made\nprimarily of carbon dioxide, which causes a strong
greenhouse\neffect that makes it the hottest planet in the solar
system\nwith surface temperatures that can reach over 460 degrees
Celsius\n(860 degrees Fahrenheit). It is also the brightest planet in
the\nsky and can be seen with the naked eye. Venus has a slow
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rotation\nthat takes longer than its orbit around the Sun, causing the sun\nto rise in the west and set in the east.\n'),
('Earth', 5.97, 12756, 5514, 9.8, 11.2, 23.9, 24.0, 149.6, 365.2, 29.8, 1, 'No', 'Yes', 'Earth is the third planet from the Sun and the only known\nplanet that harbors life. It has a diameter of 12,742 kilometers\nand a mass of approximately 5.97 x 10^24 kg. Earth has one natural\nsatellite, the Moon, and its rotation on its axis creates the 24-hour\nday and night cycle. Its orbit around the Sun takes approximately\n365.25 days, creating the concept of a year. Earth atmosphere is\ncomposed mainly of nitrogen and oxygen, which is essential for\nsupporting life. Its surface is mostly covered with water, which\nmakes up about 71% of its total surface area. Earth is also home\nto a wide variety of plants and animals.\n'),
('Mars', 0.642, 6792, 3933, 3.7, 5.0, 24.6, 24.7, 227.9, 687.0, 24.1, 2, 'No', 'No', 'Mars is the fourth planet from the Sun in our solar system,\nand is commonly referred to as the "Red Planet" due to its\nreddish appearance. It is a rocky, terrestrial planet with\na thin atmosphere, and is similar in many ways to Earth.\nIt has a diameter of about 6,792 kilometers, making it roughly\nhalf the size of Earth, and a mass of 0.642 times that of Earth.\nIt has two small moons, Phobos and Deimos.\nMars is known for its distinctive geological features, including\nthe largest volcano in the solar system, Olympus Mons, and the\ndeepest canyon in the solar system, Valles Marineris. It also has\npolar ice caps that are composed of frozen carbon dioxide and water.\nEvidence suggests that liquid water may have existed on the surface\nof Mars in the past, and there is ongoing research to investigate the\npossibility of microbial life on the planet.\n'),
('Jupiter', 1898, 142984, 1326, 23.1, 59.5, 9.9, 9.9, 778.6, 4331, 13.1, 79, 'Yes', 'Yes', 'Jupiter is the largest planet in our solar system and the fifth\nplanet from the Sun. It is a gas giant, which means that it is\ncomposed mainly of hydrogen and helium, with small amounts of\nother elements. Jupiter has a diameter of about 86,881

miles\n(139,822 kilometers) at its equator, which is more than 11 times\nthe diameter of Earth.\nJupiter has a very strong magnetic field, which is more than 20,000\ntimes stronger than Earth magnetic field. This field creates\npowerful radiation belts around the planet, which can be hazardous\nfor spacecraft.\nJupiter is known for its colorful cloud bands, which are caused\nby strong winds in the planet upper atmosphere.),
('Saturn', 568, 120536, 687, 9.0, 35.5, 10.7, 10.7, 1433.5, 10747, 9.7, 82, 'Yes', 'Yes', 'Saturn is the sixth planet from the sun and the second-largest planet\nin our solar system, with a diameter of about 116,000 kilometers.\nIt is known for its distinctive ring system, which is composed of\nnumerous small particles of ice and rock.\nSaturn is a gas giant, with a composition of primarily hydrogen and\nhelium, and it has no solid surface. The planet atmosphere is\ncharacterized by strong winds, with the fastest winds reaching speeds\nof up to 1,800 kilometers per hour. Saturn has numerous moons, with at\nleast 82 confirmed satellites, the largest of which is Titan.\nSaturn takes about 29.5 Earth years to complete one orbit around the sun,\nand its axis is tilted at an angle of about 27 degrees),
('Uranus', 86.8, 51118, 1271, 8.7, 21.3, -17.2, 17.2, 2872.5, 30589, 6.8, 27, 'Yes', 'Yes', 'Uranus is the seventh planet from the Sun and the third largest planet\nin the solar system. It has a diameter of approximately 51,118 km and\na mass of 8.68 × 10^25 kg. Uranus is classified as an ice giant, and\nlike the other gas giants in our solar system, it has no solid surface.\nUranus has a very tilted axis of rotation, which means that it essentially\nrolls around the Sun on its side. This gives Uranus very unusual seasonal\nvariations - its polar regions experience long periods of darkness and extreme\ncold, while its equatorial regions experience long periods of sunlight and heat.\nUranus has 27 known moons, the largest of which is Miranda. Uranus also has\na set of thin, dark rings that were first discovered in 1977.),

```
if result:
        output.delete('1.0', tk.END)
        output.insert(tk.END,f"Name: {result[0]}\n")
        output.insert(tk.END, f"Mass (10^24 kg): {result[1]}\n")
        output.insert(tk.END,f"Diameter (km): {result[2]}\n")
        output.insert(tk.END,f"Density (kg/m^3): {result[3]}\n")
        output.insert(tk.END,f"Gravity (m/s^2): {result[4]}\n")
        output.insert(tk.END,f"Escape Velocity (km/s): {result[5]}\n")
output.insert(tk.END,f"RotationPeriod (hours): {result[6]}\n")
        output.insert(tk.END, f"Length of Day (hours): {result[7]}\n")
output.insert(tk.END, f"Distance from Sun (10^6 km): {result[8]}\n")
        output.insert(tk.END, f"Orbital Period (days): {result[9]}\n")
        output.insert(tk.END, f"Orbital Velocity (km/s): {result[10]}\n")
        output.insert(tk.END, f"Number of Moons: {result[11]}\n")
        output.insert(tk.END, f"Ring System?: {result[12]}\n")
        output.insert(tk.END, f"Global Magnetic Field?: {result[13]}\n")
        output.insert(tk.END, f"About: {result[14]}\n")
    else:
        output.delete('1.0', tk.END)
        output.insert(tk.END, "No planet found with that name.")
('Neptune', 102, 49528, 1638, 11.0, 23.5, 16.1, 16.1, 4495.1, 59800,
5.4, 14, 'Yes', 'Yes', 'Neptune is the eighth and farthest known planet
from the sun in the\nsolar system. It is a gas giant, and has the fourth-
largest planetary\nradius and the third-largest planetary mass in the
solar system.\nNeptune atmosphere is composed primarily of
hydrogen and helium,\nwith traces of methane that give it its blue
color. The planet has\n14 known moons, including the largest one
called Triton, which is\nbelieved to be a captured Kuiper Belt object.
Neptune has a strong\nmagnetic field, which is tilted at an angle of 47
degrees relative\nto its rotational axis. It has a relatively long orbital
period of\n164.8 Earth years and takes almost 165 Earth years to
complete a\nsingle rotation on its axis. Neptune was first observed by
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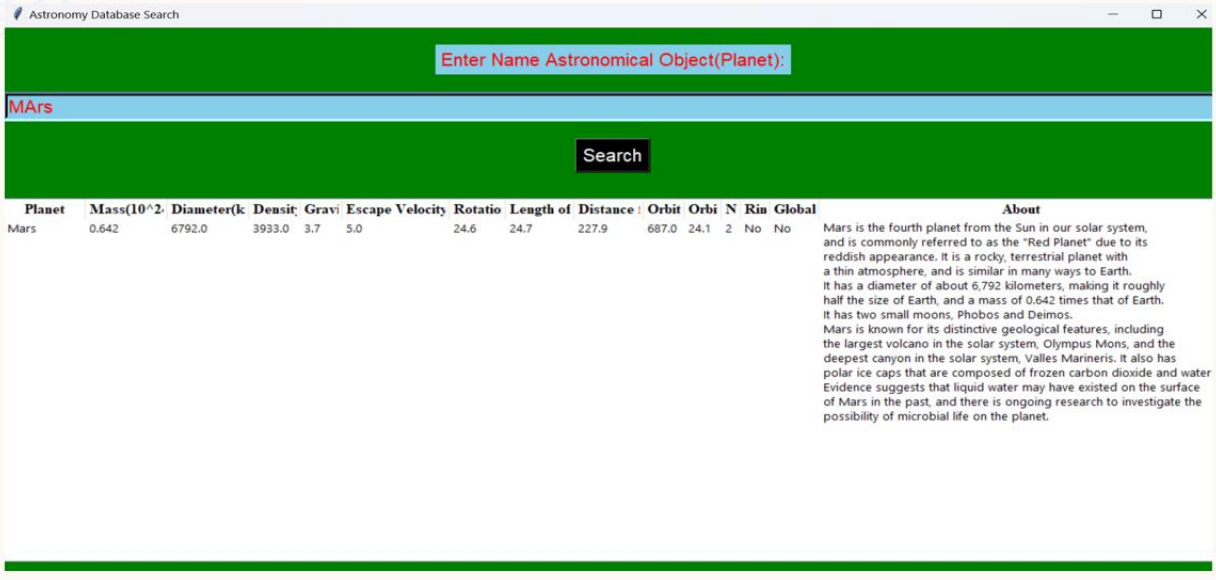
Galileo\nGalilei in 1612 and was later identified as a planet by Johann
Galle in 1846.\n')]
c.executemany('INSERT INTO planets VALUES
(?,?,?,?,?,?,?,?,?,?,?,?,?,?,?)', data1)
conn.commit()
 # Create the GUI
root = tk.Tk()
root.title("Astronomy Database")
 # Search function
def search(search_box=None):
    planet = search_box.get().capitalize()
    c.execute(f"SELECT * FROM planets WHERE name =? '{planet}'")
    result = c.fetch()
```


FIGURE 2



THANK YOU